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OPERATION AND MAINTENANCE MANUAL FOR THE EXPENDABLE PROBES DATA--ETC(U)
JAN 82 C R HOLLAND, R T MILES, R A BROWN
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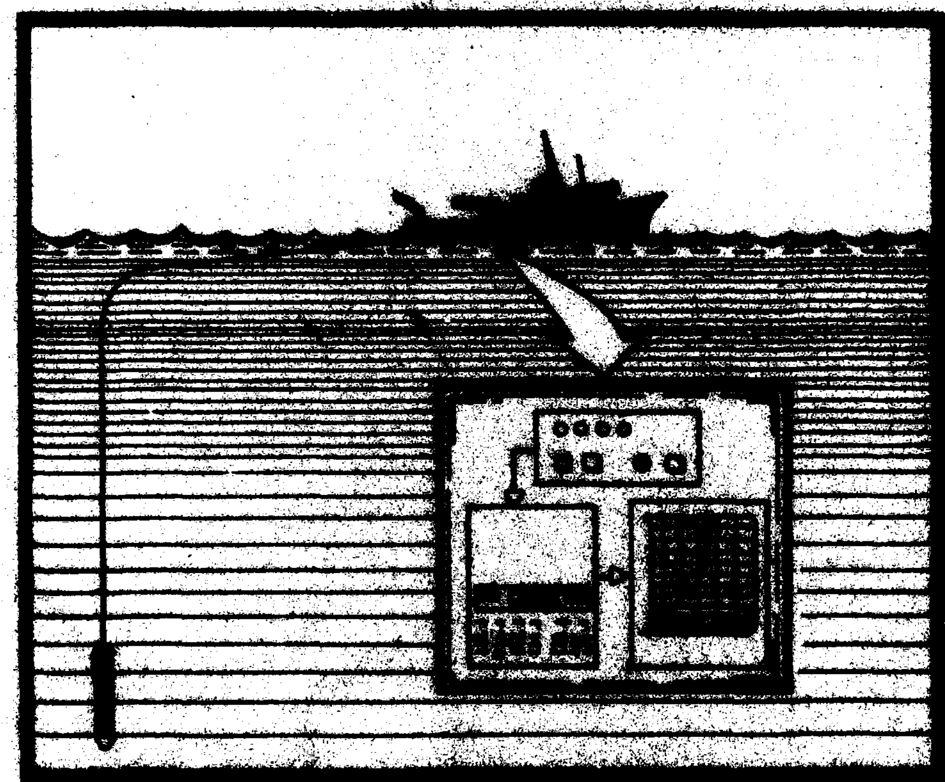
Naval Ocean Research
and Development Activity
NSTL Station, Mississippi 39529

Operation and Maintenance Manual for the Expendable Probes Data Acquisition System



EXECUTIVE SUMMARY

The Ocean Programs Management Office (Code 540) of the Naval Ocean Research and Development Activity (NORDA) provided funds in the fall of 1979 and again in 1980 to the Ocean Technology Division (Code 350), Ocean Science and Technology Laboratory, for expansion of the NORDA XBT Data Acquisition System into an Expendable Probes Data Acquisition System. This expansion accomplished two major goals: (1) The development of systems that can collect data in digital form from all commercially available expendable oceanographic probes; and (2) The addition of sufficient system hardware to permit fielding of two systems simultaneously. The expendable probes accommodated are: the Hermes SSQ-36 BTS and Sippican DAXBT Airborne Expendable Bathythermographs (AXBT), the Sippican XSV-1 and XSV-2 Expendable Sound Velocity (XSV) probes and the Grundy XSTD Expendable Salinity Temperature and Depth (XSTD) probe. The system is sufficiently flexible that other types of probes may easily be interfaced as they become available.

The ~~system is~~ designed to collect, store, and display data from a single probe launch at a rate of 20 samples/sec. However, multiple probe launches may be accommodated, the number of probes depending upon desired sample rate and type of probe used.

This manual describes the functional operation, interconnections for system set-up, and library operating programs of the expanded system. The systems are quite flexible in that the user can easily modify any of the library programs or develop new programs which tailor each system's performance to his specific needs. Considerable redundancy has been provided in the design so that failures can be quickly bypassed. The electronics are modularly constructed so that repairs can be effected by rapid replacement. In addition to collection and storage of raw data, the systems have the ability to make off-line conversions to Engineering Units and to prepare converted data in numerous printed and plotted formats for assessment of quality and completeness. These "data looks" can also be used to fine tune an experiment scenario on site in order to maximize results.

This system is available to ocean researchers. Those having an interest in making use of this system should contact the Ocean Programs Office at NORDA.

CONTENTS

ILLUSTRATIONS

TABLES

1.0 INTRODUCTION

1.1 SYSTEM PURPOSE

The NORDA XBT Data Acquisition System is a programmable data collection and processing system designed to accommodate standard ship-launched XBTs. The system is described in NORDA Technical Note 60, "Operation and Maintenance Manual for the XBT Data Acquisition System." The NORDA Expendable Probes Data Acquisition System, described herein, is designed to expand the capabilities of the XBT Data Acquisition System to include collection and processing of data from other types of expendable ocean measurement probes, specifically those which produce an output in the form of a variable frequency.

The system facilitates rapid collection of ocean data from one to four vertically descending sensor probes, which may be any of the types listed below.

a. Sippican XSV-1 and XSV-2 expendable sound velocity probes.
b. Sippican and Hermes air-launched expendable bathythermograph probes (AXBT).
c. Grundy XSTD expendable conductivity-temperature-depth probes.

The system is capable of operating in a number of modes and is sufficiently general purpose to permit interfacing of other frequency output expendable probes as they become available in the future.

1.2 SYSTEM FEATURES

For ship-launched operations, the system accepts probe data from up to four launch stations as shown in Figure 1. The launch stations provide the necessary connection between the data interface unit and the hand-held probe launchers. In addition, each launch station provides a sound powered phone connection for facilitating communication between the launch station operator and the Data Interface unit operator.

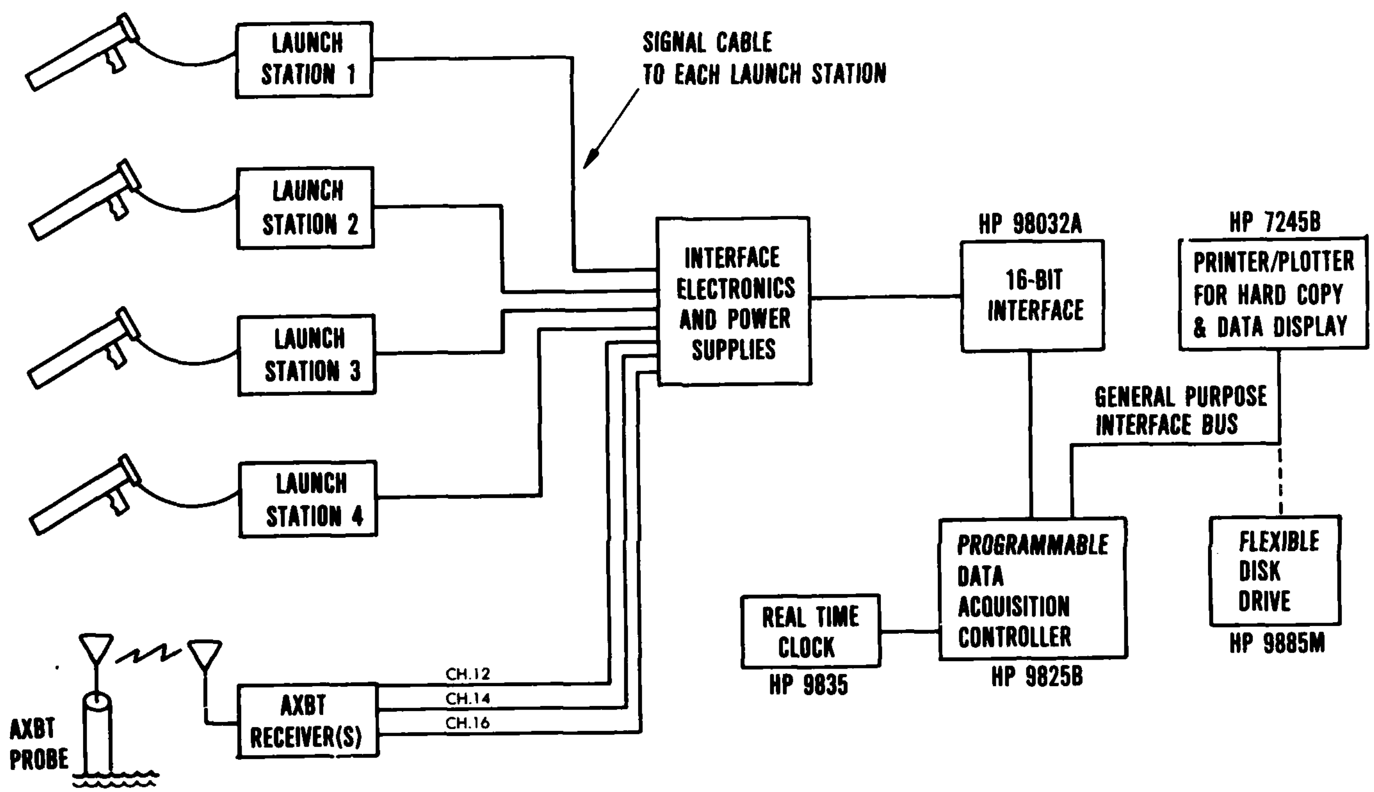


Figure 1. Expendable probes data acquisition system XSV, AXBT, and XSTD probes

For air-launched operations the Data Interface unit accepts data directly from up to three receiver channels, and no launch stations are used. The three data sources at the aircraft receiver(s) correspond to VHF channels 12, 14, and 16, and are connected to the Data Interface unit by means of special cables utilizing twist-on BNC connectors.

As shown in Figure 2, the Data Interface unit accepts the analog signals (variable frequency) from each of the launch stations or receiver channels, and applies them to individual analog conditioning cards. The analog circuits amplify, filter, and convert the signal to a form which can be accepted by digital processing circuits.

The digital processing circuits consist of up to four period counter cards, one for each launch station or receiver channel in use. The period counter card accepts the preconditioned signal from its associated analog card and uses it to compute signal period (the reciprocal of frequency). This signal period is provided in the form of a 16-bit binary count available for transmission via the HP98032 16-bit interface to the HP9825T controller for examination and storage. The period counter cards also provide the necessary handshake logic to operate with the HP98032 16-bit interface, under program control of the HP9825T calculator.

The Data Interface unit also contains launch status circuitry, consisting of one card which monitors signal input from each launch station or receiver channel, and provides a status level to the HP9825T calculator via the period counter cards to indicate that a probe has been launched. This level also drives individual probe launch indicator lights located on the front panel of the Data Interface unit.

All period counter cards are interchangeable, and these cards, as well as the launch status card, may be used with any of the three types of probes listed in section 1.1. However, the analog conditioning cards are specifically designed for each type of probe, and the proper analog card must be installed prior to use with a particular probe, see section 2.2.1.

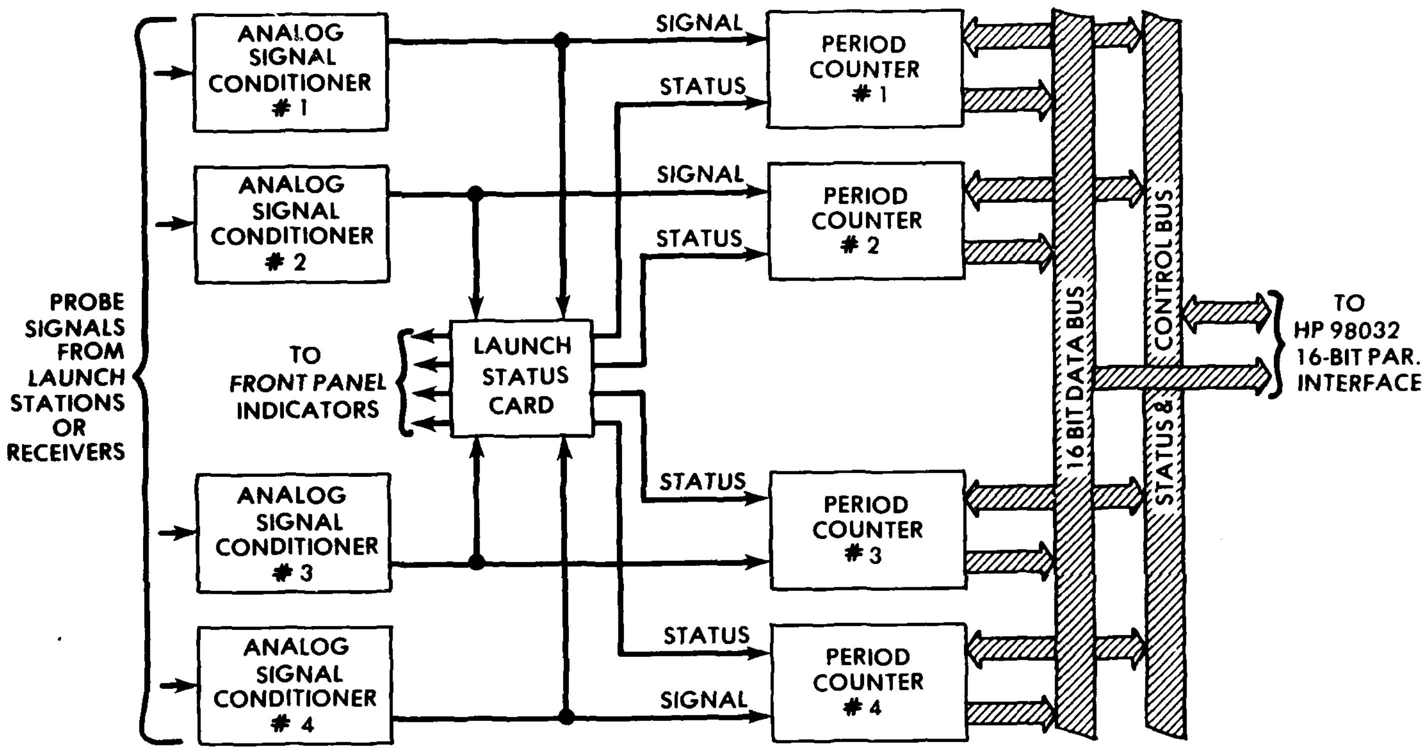


Figure 2. Data interface unit block diagram

The HP9825T calculator serves as the main data acquisition controller for the Expendable Probes Data Acquisition System, determining when to take data, what channels are active, what data is valid, and where the data should be stored until needed for quality assurance inspection. Details of the programs written for collection of data are contained in Section 3.0, System Operation.

During data collection, valid data is stored on cassette tape within the HP9825T. If desired, software can be provided which will allow storage of data on 9-track magnetic tape or 8-1/2" flexible disk.

Once a data collection period has been completed (for example, completion of one set of probe drops, or completion of all probe drops), the stored raw data can be converted to Engineering Units under program control, and the Engineering Units data is re-stored in the tape files adjacent to the associated raw data.

Once Engineering Units data is available, plotting routines are provided to allow plotting of data on the HP7245A printer-plotter for purposes of data quality assurance. These allow the plotting of data from any selected run as a function of depth.

1.3 PERFORMANCE CHARACTERISTICS

The Expendable Probes Data Acquisition System in its present hardware/software configuration performs with the following characteristics: (It should be noted, however, that these characteristics are not fixed and can be widely varied to suit other data collection requirements.)

1. For shipboard operations, the system has four identical launch stations, each capable of being connected to a hand held launcher. The launchers and launch stations are capable of accommodating any of the ship-launched probes listed in section 1.1 (i.e. XSV-1, XSV-2, AXBT, XSTD).
2. For airborne operations, three inputs are available for direct connection of up to three airborne receiver outputs (VHF channels 12, 14, 16), which provide data from air-launched expendable bathythermographs (AXBT).

Software is provided for data collection from both Sippican and Hermes AXBT's, and with minor software changes, Magnavox AXBTs may also be used.

3. Data collection range and resolution characteristics are as follows:
   a. Sippican XSV-1, XSV-2
      Sound Velocity Range - 1404 to 1560 meter/sec
      Sound Velocity Resolution - 0.06 meters/sec
      Depth Resolution - 0.3 meters
   b. Grundy XSTD
      Conductivity Range - 25 to 65 mmhos/cm
      Conductivity Resolution - 0.01 mmhos/cm
      Temperature Range - -2^{o} to 35^{o}C
      Temperature Resolution - 0.01^{o}C
      Depth Resolution - 0.3 meter
   c. Sippican and Hermes AXBT
      Temperature Range - -2^{o}C to 40^{o}C
      Temperature Resolution - 0.01^{o}C
      Depth Resolution - 0.02 meter
4. The basic system sample rate is 20 samples/second with each sample being time related to any other sample of that particular probe profile to within $\pm$ 50 milliseconds.
5. The present system software provides for launching and data collection of a single probe. If desired, additional software can be provided which will allow launching of more than one probe simultaneously, the number of probes depending upon required sample rate and type of probe used.
6. Collected data is stored on the calculator's cassette tape in raw form and in scaled Engineering Units. Additional software can be provided which will allow storage of data on either 9-track digital tape or 8-1/2" flexible disk.
7. Data quality assurance programs are provided which permit graphical plotting and inspection of data profiles for any selected probe drop. Additional software can be provided to permit plotting of other types of data presentation.

2.0 SYSTEM CONFIGURATION

2.1 SYSTEM INTERCONNECTIONS

Figure 3 illustrates the cable interconnections that need to be made between each of the functional units. The following considerations will assist in properly configuring the system:

1. The launch stations are connected to the Data Interface unit via special cable and multi-pin plugs. All of these cables are identical and any cable may be used to connect any launch station to the Data Interface unit. Remember that whichever launch station is connected to the Data Interface unit's launch station #1 connector becomes launch station #1, etc. This is important because the system software requires information from the Data Interface operator as to which launch station is about to be used prior to starting data collection.
2. The hand-held launchers provided with the system are connected to the individual launch stations via a terminal strip. The red, green, black, and shield conductors are connected as shown in Figure 3.
3. Connection between the HP9825T calculator and the Data Interface unit is via the HP98032A 16-bit parallel interface. The 98032A plugs into one of the three interface slots at the back of the HP9825, and an integral cable and connector is used to connect to the Data Interface unit.
4. Connection between the HP9825 calculator and the HP7245A Printer-Plotter is via the HP98034 HPIB interface. This unit plugs into one of the three interface slots at the back of the 9825 and the other end plugs into the appropriate HPIB connector at the back of the 7245.
5. For the HP9825 calculator to function properly, it must have a HP98035 real time clock module plugged into one of the three slots at the rear of the unit.
6. In making power connections to each of the electronic enclosures, it is very important to connect each unit to the same phase of the 115 VAC 60HZ power system to prevent troublesome AC power ground loops. It is recommended that all units be plugged into a power strip and this strip plugged

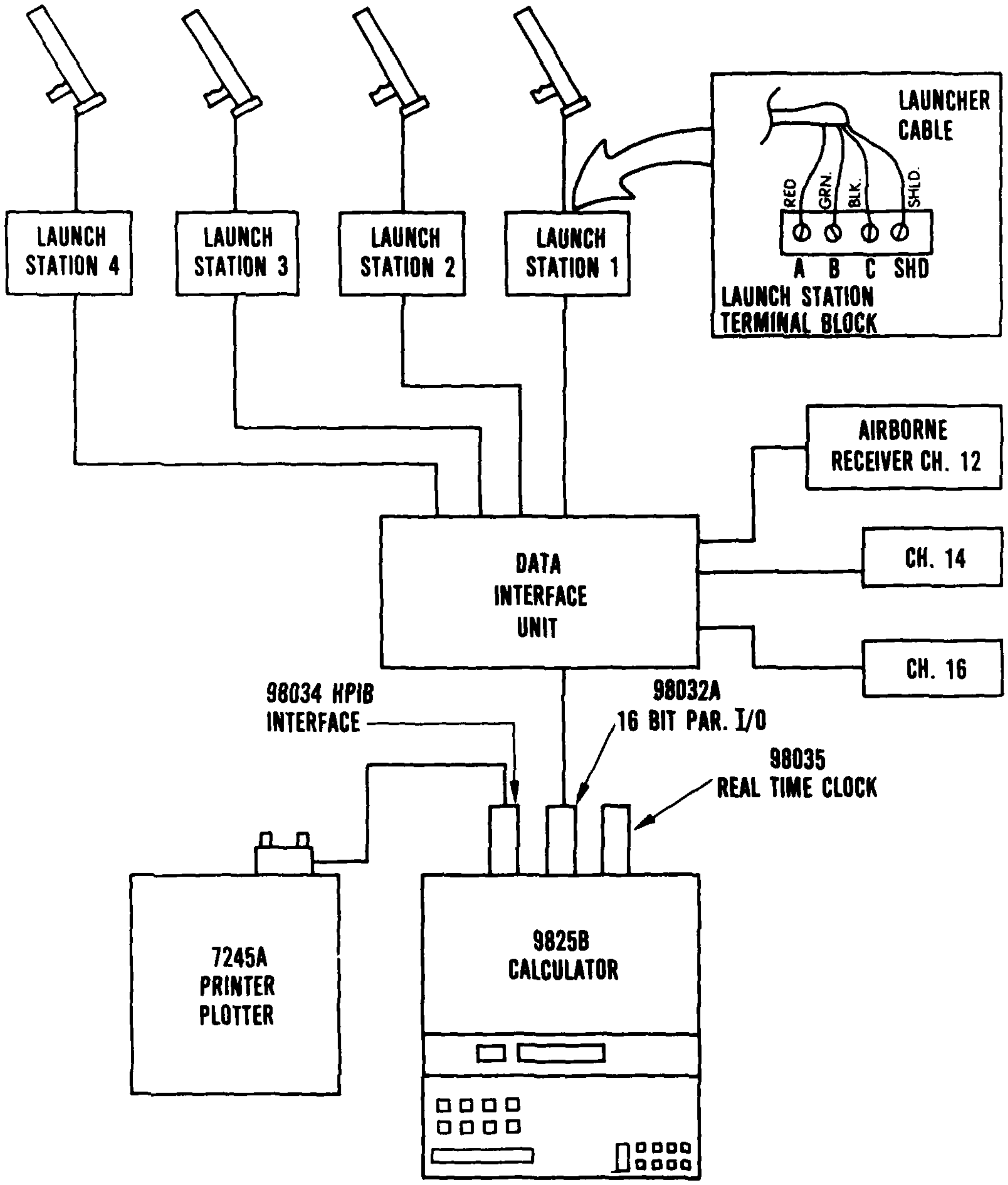


Figure 3. System interconnections

into a single power source outlet. If this measure does not completely remove power ground loops, it is recommended that an isolation transformer of 500 VA rating or greater be placed between the power strip and the power source outlet. This last measure is particularly important for airborne operations.

7. Grounding is very important to proper operation of the Expendable Probe Data Acquisition System. Signal and power grounds and shields have been carefully carried through the system to a single point on the chassis of the Data Station. For shipboard operations the ground post located near the power socket should be connected via a ground wire of AWG #14 or #16 to a bright clean hull (ship) ground. CAUTION: The importance of this hull ground being high quality cannot be overemphasized. For airborne operations, do NOT connect the ground post to the aircraft frame.

2.2 DATA INTERFACE UNIT CARD CONFIGURATION

Prior to its use in the field, the Data Interface unit must be properly configured. This consists of installing cards with proper internal switch settings into the appropriate slots.

2.2.1 Analog Conditioning Card Selection and Installation.

Each of the three types of probes used with the system requires its own analog conditioning cards. The cards are clearly marked on the track side and on the pull-out handle designating card type and number. The unit is capable of accepting four XSV, three AXBT, or two XSTD probes. The respective cards plug into the analog card section located toward the rear of the unit, (see Figure 4). If XSV probes are being launched, each of the four analog card slots will be filled with an XSV card corresponding to each probe. The cards may be inserted in any order. AXBT probes only occupy three card slots since no more than three probes will be launched simultaneously. Slots 1, 2, and 3 in the analog card section will be used by the AXBT analog cards in any order. XSTD probes require more signal conditioning due to the composite/signal produced by the probe; therefore, two cards are required for each launch station. However, the unit should contain the full set of cards (four

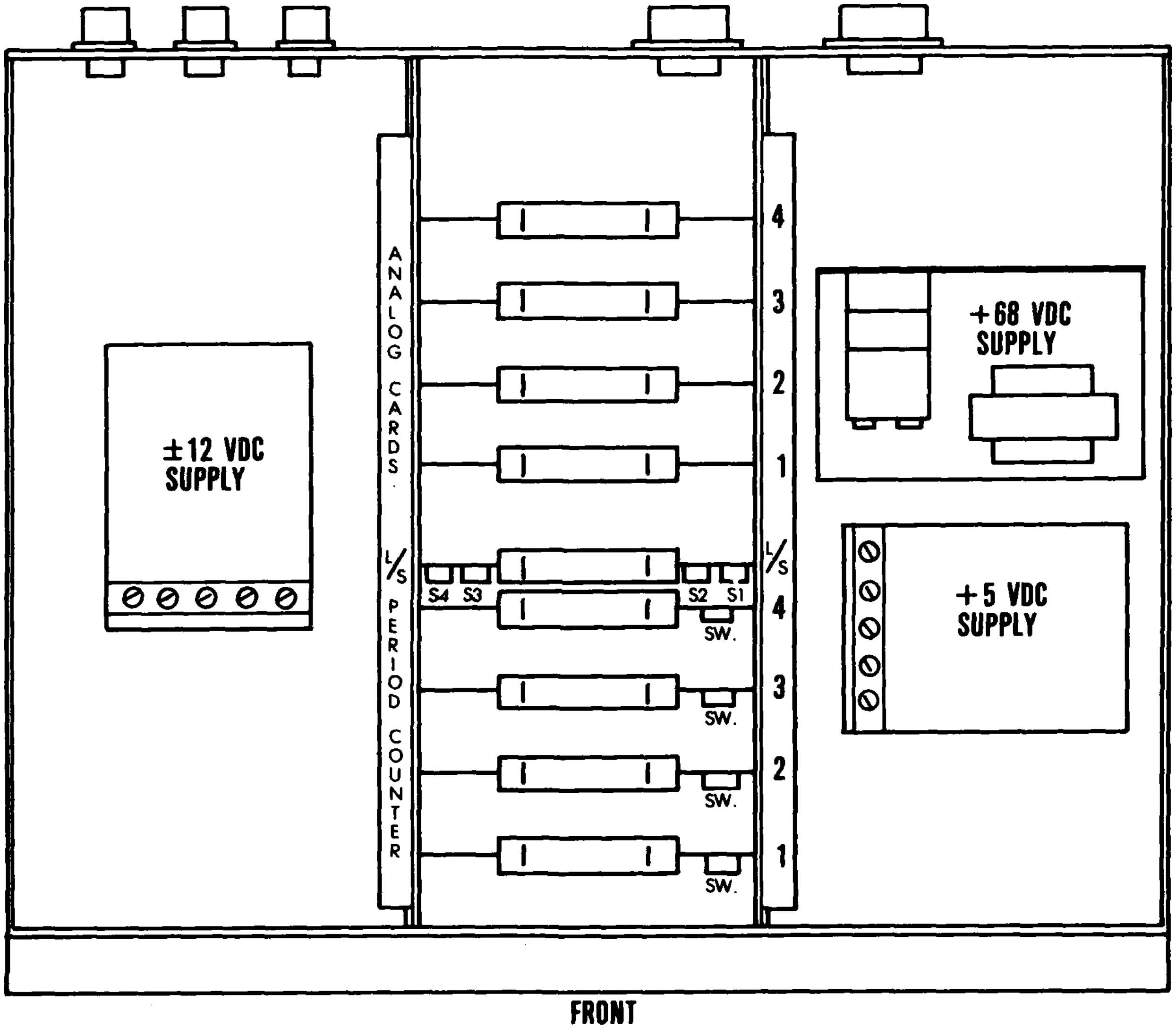


Figure 4. Expendable probe data interface unit (top view)

cards for two probes) for proper system operation. Cards 1 and 2 are inserted into slots 1 and 2 for the first probe and into slots 3 and 4 for the second probe.

2.2.2 Period Counter Card Installation.

Four period counter cards are required for full system operation. Normally, all four cards remain inserted into the unit at all times, although this is not essential for a less than four launch station operation. This will avoid possible malfunction due to accidental switch changes or card order misplacement. Internal switches are set on each card to insure proper launch station selection. Refer to Figure 4 for switch locations. Correct internal switch settings are shown in Table 1.

Table 1. Period Counter Card Switch Settings

Card No.	Switch Position			
	1	2	3	4
1	OFF	ON	OFF	ON
2	ON	OFF	OFF	ON
3	OFF	ON	ON	OFF
4	ON	OFF	ON	OFF

The period counter cards are inserted into slots 1-4, numbered front to back in the period counter section of the Data Interface unit.

2.2.3 Launch/Status Card.

The launch/status card is required during any unit configuration. Its primary purpose is to provide probe status information to assist the operator during launch. The card consists of four sets of internal switches, which, when properly configured will give an indication of failure depending on the probe being used. For instance,

the frequency of the signal of each probe will differ, requiring a different switch setting for the respective probe. If the probes' frequency goes out of range of the device being controlled by the switches, a failure will be indicated. Table 2 identifies the various internal switch settings required by the respective probe being launched.

Table 2. Launch/Status Card Switch Settings

PROBE	S1 1 2 3 4	S2 1 2 3 4	S3 1 2 3 4	S4 1 2 3 4
XSV	1 0 0 0	1 0 0 0	1 0 0 0	1 0 0 0
XSTD	1 0 0 0	0 1 0 0	1 0 0 0	0 1 0 0
AXBT	0 0 1 0	0 0 1 0	0 0 1 0	0 0 1 0

1 = ON   0 = OFF

The Launch/Status card is inserted into the slot marked "Launch/Status" located near the center of the Data Interface unit.

2.3 LOCATION OF LAUNCH STATIONS

The four identical Launch Stations are completely portable and can be located anywhere desired. The present system is supplied with 60 foot cables for each Launch Station but longer cables could be used if desired. In locating the Launch Stations, the following considerations will be helpful:

1. The Launch Station operator is alerted for "load" and "launch" operations by means of a sound powered headset. Therefore, the Launch Station should not be located next to loud sources of extraneous noise.
2. The Launch Station is moisture resistant and relatively splash proof; however, because of the connections required for the hand-held XBT probe

launcher the connection terminal strip is exposed. Once connections are made, the strip should be coated with a layer of RTV for waterproofing. In addition, it would be wise to place the box at a location protected from sea spray and rain.

3. The Launch Station enclosure is part of the system electrostatic shield and should not be permitted to touch the metallic hull; otherwise, ground loops may result. Rubber insulating feet have been provided on the enclosure bottom to prevent contact with the hull and an insulating coating applied to the top and sides, but care should be taken to ensure that objects do not touch or rest against the box.

2.4 POWER AND COOLING CONSIDERATIONS

All units in the system contain their own internal power supplies. The Data Interface Unit, Calculator, and peripherals are in turn supplied by 115VAC 60HZ 1Ø power. The 115VAC supply should be clean of transients and reasonably well regulated. This 115VAC source should be suitable for operation of computer equipment.

Cooling will not be a problem for those items located in air-conditioned spaces such as the Data Interface Unit, Calculator, and peripherals.

2.5 CAUTIONS CONCERNING GROUNDS

Both shipboard and airborne expendable probe operating environments are usually quite noisy electrically. This electrical noise can cause significant signal errors and even failure of equipment operation. Because the ship-launched probes require a return signal through the seawater and ship's hull, considerable attention must be paid to shielding and the prevention of ground loop currents during shipboard operations. The following cautions are advised:

1. The Launch Stations should be insulated from any metallic surface by resting only on its rubber feet. No craft·structural surface should touch any portion of the housing (box).

2. The Data Interface Unit should be grounded to the hull at one point only, and the quality of this ground should be very good.
3. All 115VAC power connections should be made to a single power strip and the strip plugged into a source of computer grade power. If ground loops do appear to occur, an isolation transformer should be used between the strip and the computer grade power source.
4. Peripheral units may have to be insulated from conducting surfaces.
5. Shielding and prevention of ground loop currents are somewhat different for airborne operations and the following cautions are advised:

   a. The Data Interface Unit should <u>not</u> be grounded to the aircraft frame, but it should be insulated from conducting surfaces.
   b. Peripheral units should be insulated from conducting surfaces.
   c. All 115 VAC power connections should be made to a single power strip. This strip is connected to a source of computer grade power. If ground loops do occur, an isolation transformer should be used between the strip and the computer grade power source.

3.0 <u>SYSTEM OPERATION</u>

CAUTION - Before attempting to load programs into the calculator or performing any system operations, be sure that the system interconnections specified in Section 2.1 have been made.

3.1 LOADING PROGRAMS

Prior to actual loading of software programs into the calculator's memory, it will be necessary to perform the following set-up steps:

1. Place the AC LINE switch on the right side of the calculator into the LINE (ON) position. The "lazy T" (⊢) should appear on the left-hand side of the small display screen.

2. Type the following on the calculator and press EXECUTE: (NOTE: Do not type the slash marks. Slash marks will be used to bracket items which must be typed into the calculator exactly as written).

/erase a/

/ldk 0/ (that is a zero, not an "O")

The System is now ready for a program load. The next command should be /ldf A/, where A is the file number of one of the programs specified in the following sections.

3.2 PERFORMING SYSTEM TESTS

In a normal start-up sequence where the System has just been installed aboard a ship or aircraft and is being configured for data collection, the following sequence of activities should be used:

1. /ldf 14/ This loads the address check program which tests each peripheral for proper connection to the BUS and for proper address setting.

   When using this test program or any other of the programs, it is a general rule that if the program has obviously stopped, as indicated by the absence of a RUN light in the upper left-hand corner of the display screen, the operator should press the CONTINUE key to start the next segment of the program. Now, press RUN to start the program that checks the address settings on the different peripherals. If any part of this program fails to respond properly, check the following:

   a. Are all connections in the right place and solidly connected?
   b. Are both interface modules fully inserted into the rear of the calculator?
   c. Is the cable connecting the calculator to the Data Interface Unit properly connected?
   d. Is the HPIB cable properly connected to the printer-plotter*
   e. Is the LINE light on the plotter ILLUMINATED?
   f. Is the POWER light on the Data Interface Unit ILLUMINATED?

If all of the above conditions are met then one of the interface units may be set for the wrong address. Check for the following addresses:

98034 HPIB Interface - - - - 7
98032 16 bit Interface - - - 2

2. With all the addresses checked and properly set, push the ERASE and EXECUTE keys to clear the calculator.
3. Type in /ldf 13/, and press EXECUTE, loading the Real-time clock setting program. Press RUN, CONTINUE, and answer the question "Want to change date and time?" with a /y/. Set the clock to the current date and time according to the program directions. When synchronizing the clock to some time standard, enter the time, including seconds, but do not push the last CONTINUE until the instant that set time occurs on the standard. After entering the seconds and pushing CONTINUE, the calculator will pause for a short time (10 to 25 seconds) and will display the time just entered until it is stopped using the STOP key.

3.3 MARKING DATA TAPES

Before any specific data collection program is selected and loaded into the calculator, it will be necessary to mark files on the cassette tapes that will be used to record the collected raw data, and the converted data that will follow later (see Section 3.5).

Each data tape has two tracks, and each track has room for a specific number of files, depending upon the type of probe used. To mark a tape, insert a blank cassette into the 9825 calculator and type in the following commands (note: follow each line with an EXECUTE command):

```
/trk1;ert0/
/trk0;ert0/
/trk1;fdf0/
```

Next, type in the commands as indicated below for the specific probe type which will be used.

1. For Sippican XSV-1 Probes type in:
   /mrk 20, 6740/
   /trk Ø, fdf Ø/
   /mrk 20, 6740/
   /rew/
2. For Sippican XSV-2 Probes type in:
   /mrk 8, 16100/
   /trk Ø; fdf Ø/
   /mrk 8, 16100/
   /rew/
3. For Sippican AXBT Probes type in:
   /mrk 6, 20100/
   /trk Ø; fdf Ø/
   /mrk 6, 20100/
   /rew/
4. For Hermes AXBT Probes type in:
   /mrk 14, 8100/
   /trkØ; fdfØ/
   /mrk 14, 8100/
   /rew/
5. For Grundy XSTD Probes type in:
   /mrk 14, 9940/
   /trk Ø; fdfØ/
   /mrk 14, 9940/
   /rew/

It is recommended that as many tapes be marked as will be needed for a single test leg instead of marking all the tapes needed for the whole test series, since marked tapes are not readily identifiable as new and unused.

3.4 COLLECTING DATA FROM PROBES

Separate data acquisition programs are provided for each type of probe which can be used with the system. The utilization and operator interaction with each of these three programs, is quite similar and will proceed as follows:

1. With the system properly installed, interconnected and tested, and properly marked data tapes available (Section 3.3), insert the system program tape and load the desired data acquisition program by typing:

   /erase a/
   /ldf A/

   Where A is the file number of the required programs as indicated below.
   a. All Sippican XSV - - - - - file 1
   b. All AXBT - - - - - - - - - file 3
   c. Grundy XSTD - - - - - - - - file 5
2. With the selected data acquisition program loaded into the calculator's memory, remove the system program tape and insert a data tape, which has been properly file marked as described in section 3.3.
3. Now press RUN, and the calculator will display a message to verify that the desired program has been loaded, i.e., "XSV Data Acquisition Program." The calculator will then display "Data Tape Installed?" If a data tape has been inserted per item 2. above, press CONTINUE. If not, insert the data tape at this time, and press CONTINUE.
4. The calculator will now ask the operator to enter a number which specifies the type of probe to be launched, i.e., "Probe Type? (1 = XSV1, 2 = XSV2)." Enter the proper number, and press CONTINUE.
   Note: This step is omitted if XSTD probes are used, since there is only one type available.
5. The calculator will now ask the operator to enter a run number which will be assigned to the next probe launch, i.e., the calculator displays "Run No.?". Enter the desired Run No. and press CONTINUE.
   Note: Assignment of a unique RUN NO. to each probe launch is important, since the calculator provides printed information about each launch by Run No., including exact time of launch and whether it was a normal launch or was terminated early due to failure. This printed record also provides a convenient place for writing in operator remarks and data, such as vessel or aircraft position at time of launch.
6. The calculator will now ask the operator to enter the number of the launch station to be used, i.e., the calculator displays "Launch Station?", or the

aircraft receiver channel to be used, i.e., "Channel No.?". Enter the Launch Station number or channel number as appropriate, and press CONTINUE.

7. After a period of time (up to 30 seconds), during which the calculator initializes all data storage memory, it will print, "Press CONTINUE Just Before Probe Launch." At this point the calculator is fully ready to collect data. Collection will begin as soon as the CONTINUE key is pressed and a satisfactory probe launch is detected.
8. The next steps taken by the operator will differ, depending upon whether probes are being launched from ship or aircraft.
9. For ship operation, tell the Launch Station Operator via the sound-powered communication link to LOAD a probe into the launcher. When completion of LOAD is verified, tell the Launch Station Operator to LAUNCH the probe and simultaneously press the CONTINUE key on the calculator.

   For aircraft operation, tell the aircraft personnel to LOAD and LAUNCH the AXBT, and then observe the audio and video indications on the appropriate aircraft receiver. When the AXBT enters the water and begins CARRIER transmission, as evidenced by "quieting" of the receiver channel, immediately press the CONTINUE key. Probe release will be indicated by the appearance of signal modulation in the aircraft receiver. At approximately the same time that probe launch is verified by the Launch Station Operator (or probe release indicated by the appearance of signal modulation on the aircraft receiver), the "PROBE LAUNCHED" indicator on the Data Interface Unit front panel should light, and the calculator should print the RUN NO. and start time of the probe data collection sequence. No printed start time means that valid data was <u>not</u> achieved after the launch, signifying that the probe failed prior to generating any valid data. For aircraft operations, this may be further verified by the absence of signal modulation on the aircraft reciever. In this case, press the calculator STOP key, followed by special function key fØ. Pressing the fØ key returns the program to the point at which the operator can re-enter a RUN NO., Launch Station, or Channel No., and another probe may be launched.
10. During the probe drop, the calculator will automatically collect data, test each point for validity, and store the data in memory. The run light will

be illuminated on the left of the calculator screen, indicating that the program is in operation.

11. The program will collect data for the time specified for each type probe. At the end of a data collection period (one complete probe drop), the data stored in calculator memory will be recorded on the calculator cassette.
12. When all data has been stored, the calculator prints "RUN NO.___FINISHED, READY FOR NEXT RUN", and will then display "RUN NO.?" in preparation for launching another probe.
13. If, after the start of data collection, a probe fails to provide valid data for a specific number of consecutive samples (depending on probe type), the calculator will assume that the probe has failed, and will immediately store all previous valid data on the cassette. The calculator will then print "BAD PROBE, RUN NO.____TERMINATED" and "READY FOR NEXT RUN". "RUN NO.?" will then be displayed, in preparation for launching another probe. In this situation, do <u>not</u> use the terminated run number again. Use a new run number.
14. If the currently used data cassette is filled, the calculator will print "Change Data Tape IMMEDIATELY!" and will reinitialize the program so that probe drops may be continued after insertion of a new data tape.

3.4.1 Data Collection Differences Between Programs

The major difference between the data acquisition programs for each of the three probe types is in the period of time for which data is collected and the number of samples taken. Data is taken at 20 samples/second for a specific time period, which corresponds to the time required for the probe to reach its maximum depth. At the end of this time all data points in memory are recorded on cassette tape, and the program normally cycles back to the point at which it asks the operator for the next Run Number.

Time period and number of samples for each probe type are as follows:

a. Sippican XSV-1 - - - - - - - - 166 sec. - - - - - - - - - - 3,320 samples
b. Sippican XSV-2 - - - - - - - - 400 sec. - - - - - - - - - - 8,000 samples
c. Sippican AXBT - - - - - - - - 500 sec. - - - - - - - - - 10,000 samples

d. Hermes AXBT - - - - - - - - - 200 sec. - - - - - - - - - - 4,000 samples

e. Grundy XSTD - - - - - - - - - 123 sec. - - - - - - - - - - 2,460 samples

3.5 CONVERTING DATA TO ENGINEERING UNITS

Because of the rate at which data are being collected during a probe drop, insufficient time is available for conversion to Engineering Units as a part of the data acquisition program. Therefore, separate Engineering Units Conversion Programs are provided for each probe type, so that conversion can be done at the end of a set of probe drops or at the end of all probe drops. File numbers for these programs are as follows:

a. All XSV - - - - - file 2

b. All AXBT - - - - file 4

c. XSTD - - - - - - file 6

To convert data, insert the system program tape and type:

```
/erase a/
/ldf A/
```

where A is the file number of the appropriate Engineering Units Conversion Program. Now remove the program tape and insert the cassette tape containing the raw data to be converted, and press RUN key.

2. The calculator will display the name of the program, i.e., "XSV Engineering Units Conversion Program," and print "Insert Data Tape and press CONTINUE." If the data tape is properly inserted, press CONTINUE.
3. If XSV or AXBT data are being converted, the calculator will now prompt the operator to enter a number specifying the type of probe, i.e., "Probe Type? (1 = XSV1, 2 = XSV2)." (This step will be omitted if XSTD data is being converted.) Type in the Probe Type as appropriate, and press CONTINUE.
4. The calculator will now display "To Start, Press Continue Again". Press CONTINUE, and the program will now begin converting raw data.

5. When all raw data has been converted, the calculator will print "Conversions Done, Change Data Tape, and Press Continue."

3.6 DATA PROFILE PLOTTING

Separate programs have been provided for each type of probe to enable plotting of data versus calculated depth profiles. File numbers for these programs are as follows:

a. XSV - - - - - - file 7
b. AXBT - - - - - file 9
c. XSTD - - - - - file 11

To plot a profile of data versus depth for any specific probe drop, first insert the system program tape and type:

```
/erase a/
/ldf A/
```

where A is the number of the file which contains the appropriate plotting program.

1. Remove the program tape, and insert the tape containing the data to be plotted (this data <u>must</u> be in Engineering Units).
2. Press the RUN key on the calculator.
3. The calculator will display the name of the program, i.e., "XSV Plotting Program," and will prompt the operator to specify probe type, i.e., "Probe Type? (1 or 2)." (The Probe Type prompt will be omitted for XSTD plots.) Type in the probe type as appropriate, and press the CONTINUE key.
4. The calculator will then initialize program variables and ask the operator to enter the RUN NO. for the data to be plotted. Type in the RUN NO. and press CONTINUE.
5. The calculator will now search the data for the correct run number. Once the correct run number is located, the data is loaded from the tape into

memory and plotting is initiated. If the specified run no. is not found, the calculator will print "DESIGNATED RUN NOT FOUND ON THIS TAPE - INSERT NEW TAPE AND PRESS CONTINUE."

6. The data plot is identified at the top by RUN NO. and time of launch. When the plot is complete, the calculator prints "Plot Finished - If More Plots Required, Press RESET, and RUN."

4.0 WHAT IF THINGS GO WRONG?

The Expendable Probes Data Acquisition System has been designed with considerable redundancy in mind. Sufficient spare circuit cards and functional subunits have been provided to permit 100% backup for all functions as described in the following sections.

4.1 HARDWARE CONSIDERATIONS

4.1.1 Launch Station Repairs

Launch Stations are identical, and any unit can be substituted for any other Launch Station unit. However, if Launch Stations are interchanged, the launch station designations, #1, #2, etc., also change; i.e., if stations #1 and #4 are swapped (because #1 failed) then the original station #4 becomes station #1 and must be treated accordingly. Anticipated use should see two stations in use at any one time, therefore, a 100% backup exists.

4.1.2 Data Interface Unit Repairs

There is one ±15V power supply, one +5V power supply, and one 68V unregulated power supply in the Data Interface Unit. The ±15V and +5V supplies provide all Data Interface Unit electronics, while the +68V unregulated supply provides power for operation of XSTD probes. If any of these supplies fail, it must be replaced before continuing operations (this is true of the +68V supply only if XSTD probes are used).

CAUTION: When replacing power supplies, pay very close attention to polarity and color codes.

All analog printed circuit cards are interchangeable (for the same type sensor) and may either be replaced with available spares or with a card from another analog card slot.

If the launch/status printed circuit card must be replaced, be sure to set the switches on the new card to the proper positions for the type of probe being used (see section 2.2.3).

All period counter cards are completely interchangeable, but care should be taken to assure that period counter card switches are properly set to ensure proper launch station selection (see section 2.2.2).

4.1.3 Calculator and Peripherals Repair

The HP9825 calculator, HP98032 16 bit interface, HPIB interface, cable, and realtime clock are all backed up by substitute units which can be directly inserted or interconnected in place of the malfunctioning unit. Since each calculator contains a cassette tape recording unit, 100% redundancy is provided for recording data. Printed circuit boards are also easily exchangeable between calculators should one calculator fail but its cassette recorder remain good while the other calculator suffers a tape unit failure. Simply follow the HP calculator manual for directions in changing out printed circuit cards.

4.2 SOFTWARE CONSIDERATIONS

4.2.1 Special Function Key

The fØ Key permits a system restart in the event that a launched probe fails prior to the generation of any good data. The main operating program checks the output of the Launch/Status card whenever the program is in run mode. Prior to the probe launch, the status output indicates no probe output. Once launch has been

commanded, the probe should provide valid output immediately upon water entry. If this does not happen, no launch time will be printed, and the operator will know that the computer is still waiting for launch. Since launch has occurred, the probe must have failed, and a substitute probe should be launched. Depressing "STOP" and then the fØ Key resets the system and provides automatic prompts to the operator for beginning a new run.

NOTE: The execution (depressing) of any Special Function Key normally occurs when the calculator is not in run mode; i.e., the run light is off. If the run light is on, the STOP key normally must be pressed first, followed by the Special Function Key desired.

4.2.2 Address Checks for Peripherals

This program permits checking of each of the peripherals connected to the HP9825B to ensure proper electrical connections and interchange of commands. The program carries the operator step by step with prompts and upon completion has ensured that all peripherals are connected, properly addressed, and functioning with the Bus. It is helpful to utilize this test once the System interconnections specified in Section 2.1 have been made.

4.2.3 Real Time Clock Check

A progam has been provided for reading or setting the Real Time Clock plugged into the rear of the HP9825 Calculator (see Section 3.2 for details). The clock can be read or set by loading this program (File 13) and following the prompts. Comparison to an independent time source will indicate the functioning status of the Clock (on time or error).

Section 5.0

Program Listings

File 1

XSV Data Acquisition Program

```
0: dsp "XSV Data Acquisition Program";wait 2000;cfg
1: dsp "Data Tape Inserted?";stp ;0→F→G
2: ent "Probe Type?(1=XSV1,2=XSV2)",P;3320→S;19→M;if P>1;8000→S;7→M
3: 0→J→K;dim T$[14],A$[2*S+10]
4: ent "Run No.?",R,"Launch Station?",L
5: for N=1 to 2S-1 by 2
6: fti (0)→A$[N,N+1]
7: next N
8: prt "Press CONTINUE","Just Before","Probe Launch";spc 2;stp
9: 1→I;0→T;R→J;P→K;if flg2;gto 22
10: wrt 9,"U1H,U1=O1,U1P50/U1G"
11: sfg 2;oni 9,"DATA";eir 9
12: gto +0
13: "DATA":fxd 0;wtc 2,L-1;fmt 1,"RUN NO.",1x,f3.0
14: if I>2S;gto "finish"
15: rds(2)→C;if bit(0,C);gto 23
16: time 25
17: on err "ERROR"
18: rdb(2)→W;0→T
19: if I=1;gto "time"
20: fti (W)→A$[I,I+1];I+2→I
21: if I=3;wrt 16.1,R;prt "PROBE LAUNCHED",T$;spc 2
22: eir 9;iret
23: T+1→T
24: if I>1;gto 26
25: eir 9;iret
26: if T>20;gto 28
27: 0→W;gto 20
28: trk G;rcf F,J,K,T$,A$;fdf F+2;F+2→F
29: beep;prt "BAD PROBE";wrt 16.1,R;prt "TERMINATED";beep;spc 2;gto 32
30: "finish":trk G;rcf F,J,K,T$,A$;fdf F+2;F+2→F
31: beep;wrt 16.1,R;prt "FINISHED";spc 2
32: if F>M;gto 34
33: prt "READY FOR","NEXT RUN";spc 2;gto 4
34: if G=0;1→G;0→F;gto 33
35: prt "Change Data Tape","IMMEDIATELY!!";spc 2;beep;wait 1000
36: dsp "Data Tape Inserted?";stp ;0→F→G;gto 4
37: "time":wrt 9,"R";red 9,T$;gto 20
38: "ERROR":
39: if rom=69 and ern=4;gto 44
40: if rom=0 and ern=30;prt "Insert Program","Tape and Type In","ldk0"
41: if rom=0 and ern=42;prt "Quickly Eject","Cassette and","Slide RECORD"
42: if rom=0 and ern=42;prt "Tab Over,","Then Replace","Tape and Type"
43: if rom=0 and ern=42;prt "cont",erl;beep;spc 3;stp
44: rds(2)→C;if bit(0,C);gto 23
45: prt "Interface Down!","Check period","Counter Card"
*15071
```

File 2

XSV Engineering Units Conversion Program

```
0: beep;dsp "XSV Engineering Units Conversion"
1: wait 2000
2: beep;prt "Insert Data Tape","& Press Continue";beep;spc 2;stp ;cfg
3: ent "Probe Type",P;-2→F;0→G
4: beep;dsp "To Start, Press Continue again";beep;stp ;if flg2;gto 6
5: dim P$[10]
6: if P>1;8000→S;7→M;"XSV-2"→P$;gto 8
7: 3320→S;19→M;"XSV-1"→P$
8: if flg2;gto 11
9: fxd 2;0→R→K;dim T$[14],A$[2*S+10]
10: 0→J;dim K$[10],E$[14],F$[2*S+10];sfg 2
11: on err "ERROR"
12: 2+F→F;if F>M;gto 14
13: gto 17
14: if G=0;1→G;0→F;gto 17
15: prt "Conversions Done","Change Data Tape","& Press Continue"
16: beep;spc 2;stp ;gto 3
17: trk G;ldf F,R,K,T$,A$
18: T$→E$;R→J;P$→K$
19: for I=1 to 2S-1 by 2
20: itf(A$[I,I+1])→T;if T<0;65536+T→T
21: if T=0;0→V;gto 24
22: T*1e-7→T;1/T→U
23: .052/(1/128U-2e-7)→V;V-1400→V;100V→V;int(V)→V
24: fti (V)→F$[I,I+1]
25: next I
26: on err "ERROR"
27: trk G;rcf F+1,J,K$,E$,F$
28: gto 11
29: "ERROR":if rom=65 and ern=7;gto 26
30: if rom=0 and ern=42;prt "Remove Tape and","Slide RECORD Tab","Over,Then"
31: if rom=0 and ern=42;prt "Re-insert Tape","and Type","cont",erl;spc 2;stp
*26487
```

File 3

AXBT Data Acquisition Program

```
0: dsp "AXBT Data Acquisition Program";cfg
1: dsp "Data Tape Inserted?";stp ;0→F→G
2: ent "Probe Type?(1=SIP,2=HERM)",P;10000→S;5→M;if P>1;4000→S;13→M
3: 0→J→K;dim T$[14],A$[2*S+10]
4: ent "Run No.?",R,"Launch Station?",L
5: for N=1 to 2S-1 by 2
6: fti (0)→A$[N,N+1]
7: next N
8: prt "Press CONTINUE","Just Before","Probe Launch";spc 2;stp
9: 1→I;0→T;R→J;P→K;if flg2;gto 22
10: wrt 9,"U1H,U1=01,U1P50/U1G"
11: sfg 2;oni 9,"DATA";eir 9
12: gto +0
13: "DATA":fxd 0;wtc 2,L-1;fmt 1,"RUN NO.",1x,f3.0
14: if I>2S;gto "finish"
15: rds(2)→C;if bit(0,C);gto 23
16: time 25
17: on err "ERROR"
18: rdb(2)→W;0→T
19: if I=1;gto "time"
20: fti (W)→A$[I,I+1];I+2→I
21: if I=3;wrt 16.1,R;prt "PROBE LAUNCHED",T$;spc 2
22: eir 9;iret
23: T+1→T
24: if I>1;gto 26
25: eir 9;iret
26: if T>20;gto 28
27: 0→W;gto 20
28: trk G;rcf F,J,K,T$,A$;fdf F+2;F+2→F
29: beep;prt "BAD PROBE";wrt 16.1,R;prt "TERMINATED";beep;spc 2;gto 32
30: "finish":trk G;rcf F,J,K,T$,A$;fdf F+2;F+2→F
31: beep;wrt 16.1,R;prt "FINISHED";spc 2
32: if F>M;gto 34
33: prt "READY FOR","NEXT RUN";spc 2;gto 4
34: if G=0;1→G;0→F;gto 33
35: prt "Change Data Tape","IMMEDIATELY!!";spc 2;beep;wait 1000
36: dsp "Data Tape Inserted?";stp ;0→F→G;gto 4
37: "time":wrt 9,"R";red 9,T$;gto 20
38: "ERROR":
39: if rom=69 and ern=4;gto 44
40: if rom=0 and ern=30;prt "Insert Program","Tape and Type In","ldk0"
41: if rom=0 and ern=42;prt "Quickly Eject","Cassette and","Slide RECORD"
42: if rom=0 and ern=42;prt "Tab Over,","Then Replace","Tape and Type"
43: if rom=0 and ern=42;prt "cont",erl;beep;spc 3;stp
44: rds(2)→C;if bit(0,C);gto 23
45: prt "Interface Down!","Check period","Counter Card"
*1205
```

File 4

AXBT Engineering Units Conversion Program

```
0: beep;dsp "AXBT Engineering Units Conversion"
1: wait 2000
2: beep;prt "Insert Data Tape","& Press Continue";beep;spc 2;stp ;cfg
3: ent "Probe Type?(1=Sip,2=Herm)",P;-2}F;0}G
4: beep;dsp "To Start, Press Continue again";beep;stp ;if flg2;gto 6
5: dim P$[10]
6: if P>1;4000}S;13}M;"HERM AXBT"}P$;gto 9
7: 10000}S;5}M;"SIP AXBT"}P$;-126.662}A;.219954}B;-1.705096e-4}C
8: 7.70534e-8}D;-1.7958e-11}E;1.73823e-15}H
9: if flg2;gto 12
10: fxd 2;0}R}K;dim T$[14],A$[2*S+10]
11: 0}J;dim K$[10],E$[14],F$[2*S+10];sfg 2
12: on err "ERROR"
13: 2+F}F;if F>M;gto 15
14: gto 18
15: if G=0;1}G;0}F;gto 18
16: prt "Conversions Done","Change Data Tape","& Press Continue"
17: beep;spc 2;stp ;gto 3
18: trk G;ldf F,R,K,T$,A$
19: T$}E$;R}J;P$}K$
20: for I=1 to 2S-1 by 2
21: itf(A$[I,I+1])}T
22: if T=0;0}V;gto 26
23: T*1e-7}T;1/T}U;if P>1;gto 25
24: fxd 6;A+BU+CU^2+DU^3+EU^4+HU^5}V;gto 26
25: fxd 6;U-1440}W;W/36}V
26: prnd(V,-2)}V;100V}V;int(V)}V;fti (V)}F$[I,I+1]
27: next I
28: on err "ERROR"
29: trk G;rcf F+1,J,K$,E$,F$
30: gto 12
31: "ERROR":if rom=65 and ern=7;gto 28
32: if rom=0 and ern=42;prt "Remove Tape and","Slide RECORD Tab","Over,Then"
33: if rom=0 and ern=42;prt "Re-insert Tape","and Type","cont",erl;spc 2;stp
*25719
```

File 5
XSTD Data Acquisition Program

```
0: dsp "XSTD Data Acquisition Program";cfg
1: dsp "Data Tape Inserted?";stp ;0}F}G
2: 2460}S;13}M
3: 0}J}K;dim T$[14],A$[4S+10]
4: ent "Run No.?",R,"Launch Station?",L
5: for N=1 to 4S-1 by 2
6: fti (0)}A$[N,N+1]
7: next N
8: prt "Press CONTINUE","Just Before","Probe Launch";spc 2;stp
9: 1}I;0}T}U;R}J;if flg2;gto 28
10: wrt 9,"U1H,U1=01,U1P50/U1G"
11: sfg 2;oni 9,"DATA";eir 9
12: gto +0
13: "DATA":fxd 0;wtc 2,L-1;fmt 1,"RUN NO.",1x,f3.0
14: if I>4S;gto "finish"
15: rds(2)}C;if bit(0,C);T+1}T;gto 29
16: if I=1;time 400;gto 18
17: time 25
18: on err "ERROR"
19: rdb(2)}W;0}T
20: wtc 2,L
21: rds(2)}C;if bit(0,C);U+1}U;gto 29
22: time 25
23: on err "ERROR"
24: rdb(2)}X;0}U
25: if I=1;gto "time"
26: fti (W)}A$[I,I+1];I+2}I;fti (X)}A$[I,I+1];I+2}I
27: if I=5;wrt 16.1,R;prt "PROBE LAUNCHED",T$;spc 2
28: eir 9;iret
29: if I>1;gto 31
30: eir 9;iret
31: if T>20;gto 34
32: if U>20;gto 34
33: 0}W;gto 26
34: trk G;rcf F,J,K,T$,A$;fdf F+2;F+2}F
35: beep;prt "BAD PROBE";wrt 16.1,R;prt "TERMINATED";beep;spc 2;gto 38
36: "finish":trk G;rcf F,J,K,T$,A$;fdf F+2;F+2}F
37: beep;wrt 16.1,R;prt "FINISHED";spc 2
38: if F>M;gto 40
39: prt "READY FOR","NEXT RUN";spc 2;gto 4
40: if G=0;1}G;0}F;gto 39
41: prt "Change Data Tape","IMMEDIATELY!!";spc 2;beep;wait 1000
42: dsp "Data Tape Inserted?";stp ;0}F}G;gto 4
43: "time":wrt 9,"R";red 9,T$;gto 26
44: "ERROR":
45: if rom=69 and ern=4;wait 400;gto 50
46: if rom=0 and ern=30;prt "Insert Program","Tape and Type In","ldk0"
47: if rom=0 and ern=42;prt "Quickly Eject","Cassette and","Slide RECORD"
48: if rom=0 and ern=42;prt "Tab Over,","Then Replace","Tape and Type"
49: if rom=0 and ern=42;prt "cont",erl;beep;spc 3;stp
50: rds(2)}C;if bit(0,C);gto 29
51: prt "Interface Down!","Check period","Counter Card";spc 2;stp
*28815
```

File 6

XSTD Engineering Units Conversion Program

```
0: beep;dsp "XSTD Engineering Units Conversion"
1: wait 2000
2: beep;prt "Insert Data Tape","& Press Continue";beep;spc 2;stp ;cfg
3: -2→F;0→G
4: beep;dsp "To Start, Press Continue again";beep;stp
5: 2460→S;13→M
6: if flg2;gto 9
7: fxd 2;0→R→K;dim T$[14],A$[4*S+10]
8: 0→J;dim E$[14],F$[4*S+10];sfg 2
9: on err "ERROR"
10: 2+F→F;if F>M;gto 12
11: gto 15
12: if G=0;1→G;0→F;gto 15
13: prt "Conversions Done","Change Data Tape","& Press Continue"
14: beep;spc 2;stp ;gto 3
15: trk G;ldf F,R,K,T$,A$
16: T$→E$;R→J;1→I
17: if I>4S-1;gto 29
18: itf(A$[I,I+1])→T;if T<0;65536+T→T
19: if T<=50000;if T>=25000;gto 21
20: 0→V;gto 22
21: T*1e-7→T;1/T→U;.1949*U-43.46→V;100V→V;int(V)→V
22: fti (V)→F$[I,I+1];I+2→I
23: itf(A$[I,I+1])→W
24: if W<=20000;if W>=12500;gto 26
25: 0→W;gto 27
26: W*1e-7→X;1/X→Y;.1328*Y-41.33→Z;100Z→Z;int(Z)→Z
27: fti (Z)→F$[I,I+1];I+2→I;gto 17
28: on err "ERROR"
29: trk G;rcf F+1,J,E$,F$
30: gto 9
31: "ERROR":if rom=65 and ern=7;gto 26
32: if rom=0 and ern=42;prt "Remove Tape and","Slide RECORD Tab","Over,Then"
33: if rom=0 and ern=42;prt "Re-insert Tape","and Type","cont",erl;spc 2;stp
*9113
```

File 7

XSV Plotting Program

```
0: beep;dsp "XSV Plotting Program";wait 1500
1: fxd 0;1402→B;0→C;1→D
2: ent "Probe Type?(1 or 2)",Z;if Z>1;gto 6
3: dsp "XSV-1 Data Tape Inserted?";stp
4: 50→A;-90→E;925→F;450→G;100→H;10→K;-50→L;850→M;-25→N;19→W;fxd 5;5.3672→Q
5: fxd 0;3320→S;-50→T;gto 9
6: dsp "XSV-2 Data Tape Inserted?";stp
7: 200→A;-200→E;2200→F;1125→G;200→H;20→K;-150→L;2000→M;-75→N;fxd 5;5.5895→Q
8: fxd 0;7→W;8000→S;-100→T
9: pclr;wrt 705,"ip200,1200,7300,11000;PG"
10: wrt 705,"VA"
11: ent "RUN NO.?",R
12: scl 1380,1560,M,E;csiz 1,1
13: wrt 705,"CS20"
14: xax M,10,1400,1560,2
15: yax 1400,T,M,0,2
16: wrt 705,"CS"
17: csiz 1,1,9/7,0;plt 1435,F,1;lbl "SOUND VELOCITY (METERS/SEC)"
18: csiz 1,1,9/7,90;plt 1385,G,1;lbl "DEPTH (METERS)"
19: plt 1400,0,1;plt 1560,0,2;plt 1560,M
20: pen;plt B,A,-2;B+2→B;if B<1560;gto 20
21: A+H→A;1402→B;if A<M;gto 20
22: K→A;1420→B
23: pen;plt B,A,-2;A+K→A;if A<M;gto 23
24: B+20→B;K→A;if B<1560;gto 23
25: line
26: 0→J;dim D$[10],C$[14],E$[2S+10]
27: "DATA":trk C;ldf D,J,D$,C$,E$
28: if J=R;gto "PLOT"
29: D+2→D;if D>W;gto 31
30: gto "DATA"
31: if C=0;1→C;1→D;gto "DATA"
32: prt "DESIGNATED RUN","NOT FOUND ON","THIS TAPE";spc 2
33: prt "Insert New Tape","and Press","CONTINUE";spc 2;stp
34: 0→C;1→D;gto "DATA"
35: "PLOT":csiz 1.5,1,9/7,0
36: plt 1400,L,1;lbl D$," ","RUN NO.",R
37: plt 1400,N,1;lbl C$
38: fxd 5;-.05→U;for I=1 to 2S-1 by 2
39: U+.05→U;Q*U-.001476U^2→P
40: itf(E$[I,I+1])→X;X/100→Y;Y+1400→V
41: if V<=1560;if V>=1405;plt V,P;gto 43
42: pen
43: next I
44: beep;prt "Plot Finished";spc 2;prt "If More Plots","Required,"
45: prt "Press RESET then","Press RUN";spc 2;stp
*19225
```

File 9

AXBT Plotting Program

```
0: beep;dsp "AXBT Plotting Program";wait 1500
1: beep;dsp "AXBT Plotting Program"
2: fxd 0;1}B;0}C;1}D
3: ent "Probe Type?(1=SIP, or 2=HERM)",Z;if Z>1;gto 7
4: dsp "SIP AXBT Data Tape Inserted?";stp
5: 100}A;-90}E;850}F;500}G;100}H;-50}L;800}M;-25}N;5}W;fxd 5;1.5926}Q
6: fxd 0;10000}S;.00018}T;gto 10
7: dsp "HERM AXBT Data Tape Inserted?";stp
8: 50}A;-50}E;370}F;200}G;50}H;-35}L;350}M;-20}N;fxd 5;1.64}Q
9: fxd 0;13}W;4000}S;0}T
10: pclr;wrt 705,"ip200,1200,7300,11000;PG"
11: wrt 705,"VA"
12: ent "RUN NO.?",R
13: scl -3,25,M,E;csiz 1,1
14: wrt 705,"CS20"
15: xax M,5,0,25,1
16: yax 0,-50,M,0,1
17: wrt 705,"CS"
18: csiz 1,1,9/7,0;plt 10,F,1;lbl "DEGREES C"
19: csiz 1,1,9/7,90;plt -2,G,1;lbl "DEPTH (METERS)"
20: plt 0,0,1;plt 25,0,2;plt 25,M
21: pen;plt B,A,-2;B+1}B;if B<25;gto 21
22: A+H}A;1}B;if A<M;gto 21
23: 10}A;5}B
24: pen;plt B,A,-2;A+10}A;if A<M;gto 24
25: B+5}B;10}A;if B<25;gto 24
26: line
27: 0}J;dim D$[10],C$[14],E$[2S+10]
28: "DATA":trk C;ldf D,J,D$,C$,E$
29: if J=R;gto "PLOT"
30: D+2}D;if D>W;gto 32
31: gto "DATA"
32: if C=0;1}C;1}D;gto "DATA"
33: prt "DESIGNATED RUN","NOT FOUND ON","THIS TAPE";spc 2
34: prt "Insert New Tape","and Press","CONTINUE";spc 2;stp
35: 0}C;1}D;gto "DATA"
36: "PLOT":csiz 1.5,1,9/7,0
37: plt 5,L,1;lbl D$," ","RUN NO.",R
38: plt 5,N,1;lbl C$
39: fxd 5;.5}U;1}V;41}Z;0}X}Y
40: for I=V to Z by 2
41: itf(E$[I,I+1])}X;X/100}X;Y+X}Y
42: next I
43: U+.05}U;Q*U-T^2}P;Y/21}Y
44: if X<=25;if X>=0;plt Y,P;gto 46
45: pen
46: if U=S*.05-.5;gto 48
47: V+2}V;Z+2}Z;0}X}Y;gto 40
48: beep;prt "Plot Finished";spc 2;prt "If More Plots","Required,"
49: prt "Press RESET then","Press RUN";spc 2;stp
*15253
```

File 11

XSTD Plotting Program

```
0: beep;dsp "XSTD Plotting Program";wait 1500
1: fxd 0;0}C;1}D;100}A;13}W;2460}S
2: dim A$[10],B$[10],C$[25],F$[10];"XSTD"}A$
3: dsp "XSTD Data Tape Inserted?";stp
4: ent "RUN NO.?",R
5: ent "PARAMETER?(T=Temp.,C=Cond.)",B$
6: if B$="T";gto 9
7: 2}B;14}E;70}F;10}G;20}H;22}K;32}L;16}M;3}N;"COND."}F$
8: "CONDUCTIVITY(MMHOS/CM)"}C$;gto 10
9: 1}B;-3}E;30}F;5}G;0}H;1}K;10}L;-2}M;"DEGREES C"}C$;1}N;"TEMP."}F$
10: pclr;wrt 705,"ip200,1200,7300,11000;PG"
11: wrt 705,"VA"
12: scl E,F,800,-120;csiz 1,1
13: wrt 705,"CS20"
14: xax 800,G,H,F,1
15: yax H,-100,800,0,1
16: wrt 705,"CS"
17: csiz 1,1,9/7,0;plt L,850,1;lbl C$
18: csiz 1,1,9/7,90;plt M,500,1;lbl "DEPTH (METERS)"
19: plt H,0,1;plt F,0,2;plt F,800
20: pen;plt K,A,-2;K+B}K;if K<F;gto 20
21: A+100}A;H+B}K;if A<800;gto 20
22: 10}A;H+G}B
23: pen;plt B,A,-2;A+10}A;if A<800;gto 23
24: B+G}B;10}A;if B<F;gto 23
25: line
26: 0}J;dim D$[14],E$[4S+10]
27: "DATA":trk C;ldf D,J,D$,E$
28: if J=R;gto "PLOT"
29: D+2}D;if D>W;gto 31
30: gto "DATA"
31: if C=0;1}C;1}D;gto "DATA"
32: prt "DESIGNATED RUN","NOT FOUND ON","THIS TAPE";spc 2
33: prt "Insert New Tape","and Press","CONTINUE";spc 2;stp
34: 0}C;1}D;gto "DATA"
35: "PLOT":csiz 1.5,1,9/7,0
36: plt H,-80,1;lbl A$," ","RUN NO.",R," ",F$
37: plt H,-45,1;lbl D$
38: fxd 5;-.05}U;for I=N to 4S-N by 4
39: itf(E$[I,I+1])}X;X/100}Y
40: U+.05}U;6.1*U}P
41: if Y<=F;if Y>=H;plt Y,P;gto 43
42: pen
43: next I
44: beep;prt "Plot Finished";spc 2;prt "If More Plots","Required,"
45: prt "Press RESET then","Press RUN";spc 2;stp
*133
```

File 13

Real Time Clock Set and/or Read Program

```
0: beep;dsp "Real Time Clock Set and/or Read";beep;stp
1: dim C$[14];ent "Want to change date and time?",C$
2: if C$≠"yes";if C$≠"y";gto 12
3: dim A$[14];" "→A$[1,14]
4: dsp "Enter date and time";wait 1000
5: dsp "as two-digit numbers";wait 1000
6: ent "Month?(CC)",A$[1,2]
7: ent "Day?(DD)",A$[4,5]
8: ent "Hour?(HH)",A$[7,8]
9: ent "Minute?(MM)",A$[10,11]
10: ent "Seconds?(SS)",A$[13,14]
11: wrt 9,"S",A$;wrt 9,"B"
12: dim B$[30]
13: wrt 9,"R";red 9,C$
14: "DATE:  "→B$[1,7];C$[1,2]→B$[8,9];"/"→B$[10,10];C$[4,5]→B$[11,12]
15: "   TIME:  "→B$[13,22];C$[7,14]→B$[23,30]
16: dsp B$
17: gto 13
*2290
```

File 14

Peripheral Address Check Program

```
0: rds(2)→A;if A=288;prt A,"DATA INTERFACE OK";spc 2;gto 3
1: prt A,"CHECK DATA","INTERFACE UNIT";spc 2;stp
2: wrt 705,"PG"
3: scl 0,100,0,100
4: pen
5: plt 25,35
6: plt 75,35
7: plt 75,65
8: plt 25,65
9: plt 25,35
10: wait 1000
11: csiz 1.5,1,9/7,0
12: pen;plt 35,50;lbl "PLOTTER OK"
13: pen;plt 38,30
*68
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The Ocean Programs Management Office (Code 540) of the Naval Ocean Research and Development Activity (NORDA) provided funds in the fall of 1979 and again in 1980 to the Ocean Technology Division (Code 350), Ocean Science and Technology Laboratory, for expansion of the NORDA XBT Data Acquisition System into an Expendable Probes Data Acquisition System. This expansion accomplished two major goals: (1) The development of systems that can collect data in digital form from all commercially available expendable oceanographic

probes; and (2) The addition of sufficient system hardware to permit fielding of the two systems simultaneously. The expendable probes accommodated are: the Hermes SSQ-36 BTS and Sippican DAXBT Airborne Expendable Bathythermographs (AXBT), the Sippican XSV-1 and SXB-2 Expendable Sound Velocity (XSV) probes and the Grundy XSTD Expendable Salinity Temperature and Depth (XSTD) probe. The system is sufficiently flexible that other types of probes may easily be interfaced as they become available.

The system is designed to collect, store, and display data from a single probe launch at a rate of 20 samples/sec. However, multiple probe launches may be accommodated, the number of probes depending upon desired sample rate and type of probe used.

This manual describes the functional operation, interconnections for system set-up, calibration procedures, and library operating programs of the expanded system. The systems are quite flexible in that the user can easily modify any of the library programs or develop new programs which tailor each system's performance to his specific needs. Considerable redundancy has been provided in the design so that failures can be quickly bypassed. The electronics are modularly constructed so that repairs can be effected by rapid replacement. In addition to collection and storage of raw data, the systems have the ability to make off-line conversions to Engineering Units and to prepare converted data in numerous printed and plotted formats for assessment of quality and completeness. These "data looks" can also be used to fine tune an experiment scenario on site in order to maximize results.

This system is available to ocean researchers. Those having an interest in making use of this system should contact the Ocean Programs Office at NORDA.

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